DEVELOPMENT AND TECHNICAL SERVICES

REVIEW OF 1982 ACTIVITIES

The Development and Technical Services function at Tucson pursued numerous 1982 projects which can be divided into four general categories as shown in the first viewgraph. The programs in each category follow with short descriptions of each.

CATEGORY A

Techno-Economic Assessments of Lithium Fluoride

The increasing cost of electrical energy has caused many aluminum smelters to modify the Hall cell electrolyte by using lithium carbonate to decrease unit power consumption. However, as the performance characteristics of the process continue to improve, the difficulty of realizing the full economic benefits of lithium carbonate addition increases unless the complex interactions between technical and economic variables are understood.

The purpose of this project was to correlate the benefit-to-cost ratio for lithium carbonate addition to the Sebree and Columbia Falls technical and economic environments and thus provide the plants with a tool for plant testing decisions.

The work on this project is documented in two reports,

"Techno-Economic Assessment of Lithium Carbonate Usage at Columbia Falls"

"Techno-Economic Assessment of Lithium Carbonate Usage at Sebree"

each being authored by S.K. Das and P.P. Russell.

Twenty-Four Day Large Anode Assessment for Sebree

Planned conversion to a large area anode at Sebree has created an opportunity to extend the life of an anode from 18 to 24 days. The purpose of this study was to investigate the technical and economic implications of a 24-day anode set cycle at Sebree.

This work is documented in a report,

"Preliminary Feasibility Study on 24-Day Anode Set Cycle at Sebree"

authored by P.P. Russell.

Potlining Recovery

The purpose of this project was to examine the feasibility of pursuing a joint project with Alcan to develop a resource recovery process for spent potlining.

A report,

"Resource Recovery from Spent Potlining"

was jointly issued by Tucson and Alcan. The report recommended that negotiations be initiated leading ultimately to an Arco Metals/Alcan joint venture.

Anode Optimization for Sebree and Columbia Falls

It is generally accepted within the aluminum industry that good anode performance is achieved by maximizing vibrated dry bulk density of coke aggregrate and by optimizing the pitching level of anode mix to produce the highest baked apparent density.

Two reports recommending laboratory and plant testing were issued,

"Proposal to Columbia Falls on Anode Formulation Optimization"

"Proposal to Sebree on Anode Formulation Optimization"

each being authored by S.K. Das and S.S. Jones.

During 1982, laboratory work was done at Tucson to determine the coke aggregate distribution which maximizes vibrated bulk density using ARCO coke for the Columbia Falls context. The results of this work is documented in a report,

"Columbia Falls Anode Formulation Optimization - Phase I - Progress Report No. 1"

authored by K.R. Weisbrod.

Sensor Development

Work on this project focused in 1982 on testing materials which have the potential of withstanding the harsh environment of an aluminum reduction cell. Also studied was a device, patented by Alcoa, which measures the heat flux from the cathode shell. To date, no material has been determined to be suitable and the heat flux device appears at this point to be useful under static air flow conditions which do not exist in practice.

A report on this work is forthcoming.

Baked Anode Core Sample Testing for the Sebree Large Anode Project

Seventy-two core samples from the Sebree regular and large baked anodes were sent to Tucson for measurement of electrical resistivity to compare quality of baking between the two anode types. It was found that the bake on the large anodes was generally as good as on the regular anodes.

This work is documented in a memorandum report,

"Results of Resistivity Measurements of Large and Regular Anodes" authored by P.P. Russell.

Large Anode Energy Savings Assessment

A set of theoretical calculations were made to estimate the unit electrical consumption rates as a function of the percent increase in anode surface area and percent increase in cell current input. For the projected 13% increase in anode cross-sectional area, the model predicted a potential 0.4

kWh/lb decrease in unit power consumption. While this number probably will not be achieved in initial operations, it establishes a goal to strive for in the years to come.

The work is documented in a report,

"Theoretical Calculations of Electrical Energy Consumption in Sebree Large Anode Cells"

authored by S.K. Das.

Economic Assessment of Coke and Pitch Specifications

Based upon the aluminum industry's empirical experience, this work quantified the effects of vanadium and sulfur in calcined coke and quinoline insolubles in coal-tar pitch on the operating and economic parameters of Hall cell operations.

The work is documented in a report on the subject authored by Das, Jones and Moran.

Economic Assessment of Changing Coke Bulk Density

The purpose of this work was to quantity the aluminum industry's empirical experience concerning the effects of coke aggregate bulk density on prebake cell operation. It was estimated that the economic premium or penalty for every 1.0 lb/ft^3 increase or decrease of coke aggregate bulk density is about $5.5/ton coke.

The work is documented in a memorandum report by S.K. Das.

Technical Assessment of Sebree Electrode Technology Five Year Plan

Sebree requested input from Tucson to aid in their development of an electrode technology five year plan.

This work is documented in a memorandum report,

"Tucson's Recommended Five Year Carbon Plan for Sebree"

authored by P.P. Russell.

Economic Assessment of Percentage Butts in the Sebree Anode

This study was made to support the Sebree large anode design activities. Formulas were derived to relate butt content to carbon consumption costs.

This work is documented in a memorandum report,

"Economic Consequences of Varying Butt Content in the Anode Aggregate Mix"

authored by S.K. Das.

Economic Assessment of Changing the Sebree Anode Bonnet Size

This work was done in response to Sebree's inquiry concerning a proposal to increase the bonnet volume on the large anode to aid in block conveying and storage design considerations. Expected cost penalties were calculated and reported in a memorandum report,

"Air Burn Cost Penalty of Increasing Bonnet Size on the Sebree Large Anode"

authored by D.S. Moran.

CATEGORY B

Fort Meade Aluminum Fluoride Tests at Sebree and Columbia Falls

The aluminum fluoride normally used at both Sebree and Columbia Falls is produced by a hydrofluoric process. Because of purchasing and availability considerations, the Louisville Materials group asked us to detemine if our plants could use successfully Alcoa's Fort Meade aluminum fluoride made from a fluosilic acid process. It was thought that the different product possibly could cause plant operating problems because of its lower bulk density and smaller particle size.

A 90 ton test of the material was tested at each plant. It was determined that the material could be used at both Sebree and Columbia Falls.

This work is documented in a report,

"Plant Testing of Alcoa Ft. Meade Aluminum Fluoride"

authored by D.S. Moran.

ARCO Coke Fines Test at Sebree

At the request of Duane Watkins, Manager of Petroleum Coke Sales for Arco Petroleum Products, a test was conducted at Sebree to determine if the excess fines produced by the Cherry Point rotary calciner could be used as a substitute for ball mill product at Sebree. Several tons of the material were tested and it was determined that ARCO fines anodes were probably

usable but severe material handling and plugged dust collector problems prevented definitive conclusions. Major plant alterations would have to be made to use the material on a full scale.

The work is documented in a report,

"ARCO Fines Final Report"

authored by R.L. Poertner.

New X-Ray Method

A new concept of bath ratio analysis by x-ray techniques originated at the Columbia Falls plant in 1979. It was felt that the new x-ray method would be much less empirical and generally more reliable than the method being currently used. The work on verifying and testing the new system was conducted by M.C. Schneller and funded by Tucson. The new method proved to be successful and was adopted by the Columbia Falls Laboratory and is now their standard system.

The work is documented by a report,

"Evaluation of a New Method of Bath Ratio Analysis by X-Ray Techniques"

authored by M.C. Schneller.

Raw Materials Quality Control

Work was begun, in conjunction with the plants, to review plant materials procedures and make recommendations to assure that the major raw materials

are within specificiations. The areas covered will be (1) Raw Material Specifications (2) Sampling Procedures (3) Analytical Methods and (4) Material Rejection Limits and Procedures.

Major work will be in 1983.

CATEGORY C

Lithium Fluoride Tests at Sebree and Columbia Falls

Tests were conducted at both plants to determine if the use of lithium will improve operating efficiencies.

(Tucson's input was explained in Category A)

Large Anode Project at Sebree

Sebree is planning to increase the surface area of their anodes plant-wide in 1983.

(Tucson's input was explained in Category A)

Magnetics Project at Columbia Falls

This Tucson funded project is being coordinated by Columbia Falls. ASV bus design technology was purchased. Tucson provided input in the negotiations and subsequent magnetic flux testing. Two pots were converted in 1982.

Mitsobishi Technology Evaluation

Tucson provided technical support to Columbia Falls as requested.

CATEGORY D

Carbon Seminars at Sebree and Columbia Falls

Intensive full-week carbon seminars were held at both Columbia Falls and Sebree. Items covered were (1) Anode and Cathode Raw Materials (2) Mix Formulation (3) Anode Operations and (4) Cathode Technology.

The seminars were conducted by S.S. Jones.

Reduction Technical Workshop

A two-day reduction technical workshop was held at Sebree. Attending were junior professionals from Columbia Falls, Sebree and Tucson. Subjects covered included bus modification and point feeder projects at Columbia Falls, the large anode project and bake furnace improvements at Sebree and the research work on composite anodes at Tucson.

The workshop was coordinated by P.P. Russell.

Aluminum Technology Presentations for all Sebree Salaried Employees

An intensive presentation was conducted at Sebree attended by all salaried employees. Emphasis was placed on the importance of technology in the aluminum industry in the past, present and future. The importance of continually improving efficiency through technology was stressed.

The presentations were made by S.K. Das.